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UNITED STATES PUBLIC HEALTH SERVICE
RUPERT BLUE, SURGEON GENERAL

MEMORY TESTS OF SCHOOL CHILDREN

MEMORY SPAN OF 1,585 WHITE SCHOOL CHILDREN (751 BOYS, 834 GIRLS) IN THE CITY OF X

BY

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REPRINT No. 316
FROM THE
PUBLIC HEALTH REPORTS

DECEMBER 24, 1915
Pages 3738-3745

WASHINGTON
GOVERNMENT PRINTING OFFICE
1916

Monograph

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MEMORY TESTS OF SCHOOL CHILDREN.[1]

MEMORY SPAN OF 1,585 WHITE SCHOOL CHILDREN (751 BOYS, 834 GIRLS) IN THE CITY OF X.[1]

By C. W. Stiles, Professor of Zoology, United States Public Health Service.

Of the 1,585 children (751 boys, 834 girls) for whom memory-span data are available, 1,223 (586 boys, 637 girls) belong to group S (from homes provided with sewer connection, but without privies), 271 (106 boys, 165 girls) belong to group P (from homes with privy sanitation), and 91 (59 boys, 32 girls) to group U (from homes of unknown sanitation).

In taking the memory span the following table was used:

Table 1.—*Strong's memory-span numbers.*[2]

3 years old:	2 numbers:	7–2
		1–6
		8–4
4 years old:	3 numbers:	7–4–8
		2–9–4
		6–3–7
6 years old:	4 numbers:	5–1–8–3
		9–2–7–4
		5–9–2–6
8 years old:	5 numbers:	4–7–3–9–5
		7–4–2–8–1
		5–8–3–7–6
10 years old:	6 numbers:	8–5–4–7–2–6
		2–7–1–6–5–1
		9–4–1–7–3–8
12 years old:	7 numbers:	2–9–6–4–3–7–5
		9–2–8–5–1–6–4
		1–3–9–5–8–4–7
	8 numbers:	4–7–2–9–3–8–1–5
		7–1–8–3–6–2–9–5
		4–6–1–5–8–2–9–7
	9 numbers:	9–2–4–7–3–8–6–1–5
		4–7–5–2–9–6–3–1–8
		9–5–8–3–7–2–6–4–1
	10 numbers:	8–3–9–5–1–6–2–7–0–4
		2–1–4–6–0–7–3–8–5–9
		4–0–5–2–8–1–7–9–6–3

[1] Reprint from the Public Health Reports, vol. 30, No. 52, Dec. 24, 1915, pp. 3738–3745. For other articles on the city of X see Public Health Reports, 1915, as follows: Difficulties in obtaining ages, v. 30(5), Jan. 29, pp. 310–311; Zooparasitic intestinal infections, v. 30(27), July 2, pp. 1991–2002; School grades, v. 30(28), July 9, pp. 2060–2067; Tobacco and snuff, v. 30(40), Oct. 1, pp. 2926–2928; Heights and weights of children, v. 30(41), Oct. 8, pp. 2990–3003; Lung capacity, v. 30(42), Oct. 15, pp. 3067–3072.

[2] Prepared by E. K. Strong, jr., professor of psychology, George Peabody College for Teachers, Nashville, Tenn.

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Method of giving the memory span.—In giving the memory-span test, we followed the method used by psychologists and psychiatrists. The test was explained to each child separately. The tester would then begin with the first line of the foregoing table and repeat deliberately and in a monotone: "Seven [very short pause], two." If the child failed to repeat these numbers in the order given, he was granted a second chance on the next line: "One, six." If he failed on this, he was given a third chance on the third line: "Eight, four." Not more than three chances were given on any one series of (2, 3, 4, 5, — x) numbers. As soon as a child repeated the 2, 3, 4, or x numbers in any series, he was tested on the next higher series. (It will be noticed that one extra number is added in each series. See foregoing table.) This was continued until the pupil failed three times on a group. He was accredited with the highest number of figures he could repeat without error. The tests were given by local substitute school teachers, who were, of course, given preliminary practice.

As I have seen this test given by other investigators, two different "stage settings" have been used. Some investigators have the "subject" in a room that is perfectly quiet and free from distraction (other than the distraction of isolation); others have the "subject" in a room that is not necessarily perfectly quiet and in which there is or may be some distraction in the way of noise or movement. There are certain arguments in favor of both methods.

In our tests separate rooms were impossible, even if desirable. The tests were made in a very large school assembly hall and the substitute school teachers were placed at intervals around the room.

The pupils passed from one teacher to another for certain different mental and physical tests. The confusion was about equal to that found in the average classroom of a well-regulated Southern school. In other words, the children were tested under conditions that corresponded as closely as possible to their daily school life. Most of the children looked upon the tests in the light of playing games; some of the pupils were not so thoroughly at their ease.

That some children did better work with this "stage setting" than they would have done if entirely isolated from the other children seems practically certain; that the reverse holds for other children is equally certain. For instance, a certain girl gave a memory span of 8 numbers; personally, I tested this same girl at her home on several occasions, and she repeatedly showed a memory span of 9 and 10 numbers.

The personal equation, as to nervousness, diffidence, etc., can not be entirely eliminated, but the results obtained show what can be reasonably expected of city school children (white) in the locality in question and with the "stage setting" that was used.

TABLE 2.—*Memory span of 751 boys, 6 to 17.75 years old, inclusive, of the city of X, summarized by quarter-year periods, total-year periods, and sanitary groups.*

[P=children from homes provided with a privy; S=children from homes with sewer connection but without a privy; U=home sanitation unknown; T=total of P, S, and U.]

Age.	Number in memory span, with number of children attaining each span.									Number of pupils.	Memory span.	
	3	4	5	6	7	8	9	10	11		Total.	Average.
6.00 T	....	1	....	....	....	....	....	....	....	1	4	4.00
6.25 T	....	3	2	1	....	....	....	....	....	6	28	4.67
6.50 T	....	3	3	6	....	....	....	....	....	12	63	5.25
6.75 T	....	2	2	2	3	1	....	....	....	10	59	5.90
6 S	....	8	5	7	2	1	....	....	....	23	121	5.26
6 P	....	1	1	2	1	....	....	....	....	5	28	5.60
6 U	....	....	1	....	....	....	....	....	....	1	5	5.00
6 T	....	9	7	9	3	1	....	....	....	29	154	5.31
7.00 T	....	3	5	6	3	....	....	....	....	17	94	5.53
7.25 T	1	1	6	11	1	1	....	....	....	21	118	5.62
7.50 T	....	1	9	5	3	....	....	....	....	18	100	5.55
7.75 T	....	2	6	6	3	....	....	....	....	17	95	5.59
7 S	....	3	21	23	9	1	....	....	....	57	326	5.72
7 P	....	4	4	4	1	....	....	....	....	13	67	5.15
7 U	1	....	1	1	....	....	....	....	....	3	14	4.67
7 T	1	7	26	28	10	1	....	....	....	73	407	5.57
8.00 T	....	....	3	9	5	1	....	....	....	18	112	6.22
8.25 T	....	2	3	4	4	3	....	....	....	16	99	6.19
8.50 T	....	....	2	13	8	....	....	....	....	23	144	6.26
8.75 T	....	....	4	6	9	3	....	....	....	22	143	6.50
8 S	....	2	9	25	22	7	....	....	....	65	413	6.35
8 P	....	....	3	5	4	....	....	....	....	12	73	6.08
8 U	....	....	....	2	....	....	....	....	....	2	12	6.00
8 T	....	2	12	32	26	7	....	....	....	79	498	6.30
9.00 T	....	1	4	5	9	4	1	....	....	24	158	6.58
9.25 T	....	2	1	11	4	3	....	1	....	22	141	6.41
9.50 T	....	2	5	5	8	4	1	....	....	25	160	6.40
9.75 T	....	1	5	5	5	5	....	....	....	21	134	6.38
9 S	....	5	10	20	22	16	2	1	....	76	500	6.58
9 P	....	....	5	4	3	....	....	....	....	12	70	5.83
9 U	....	1	....	2	1	....	....	....	....	4	23	5.75
9 T	....	6	15	26	26	16	2	1	....	92	593	6.45
10.00 T	....	....	6	5	6	5	1	....	....	23	151	6.57
10.25 T	....	....	1	6	17	1	2	....	....	27	186	6.89
10.50 T	....	....	1	11	9	3	1	....	....	25	167	6.68
10.75 T	....	....	2	4	8	8	....	....	....	22	154	7.00
10 S	....	....	8	17	33	13	4	....	....	75	513	6.84
10 P	....	....	1	6	3	2	....	....	....	12	78	6.50
10 U	....	....	1	3	4	2	....	....	....	10	67	6.70
10 T	....	....	10	26	40	17	4	....	....	97	658	6.78
11.00 T	....	1	3	7	7	6	2	....	....	26	176	6.77
11.25 T	....	....	3	10	8	4	....	....	....	25	163	6.52
11.50 T	....	2	....	9	6	3	....	....	....	20	128	6.40
11.75 T	....	....	1	7	6	1	....	....	....	15	97	6.47
11 S	....	1	6	26	11	14	2	....	....	60	397	6.62
11 P	....	1	1	6	13	....	....	....	....	21	136	6.48
11 U	....	1	....	1	3	....	....	....	....	5	31	6.20
11 T	....	3	7	33	27	14	2	....	....	86	564	6.56
12.00 T	....	....	2	9	3	3	....	....	....	17	109	6.41
12.25 T	....	....	....	6	6	4	2	....	....	18	128	7.11
12.50 T	....	....	2	5	9	3	2	1	....	22	155	7.05
12.75 T	....	....	2	3	4	2	1	1	....	13	91	7.00
12 S	....	....	5	18	15	10	4	....	....	52	354	6.81
12 P	....	....	1	3	3	....	1	2	....	10	73	7.30
12 U	....	....	....	2	4	2	....	....	....	8	56	7.00
12 T	....	....	6	23	22	12	5	2	....	70	483	6.90
13.00 T	....	1	....	7	6	....	1	....	....	15	97	6.47
13.25 T	....	....	2	2	7	3	1	....	....	15	104	6.93
13.50 T	....	....	3	4	12	8	....	....	....	27	187	6.93
13.75 T	....	....	1	1	6	5	....	....	....	13	93	7.15
13 S	....	1	4	13	23	13	2	....	....	56	385	6.87
13 P	....	....	2	1	6	....	....	....	....	9	58	6.44
13 U	....	....	....	....	2	3	....	....	....	5	38	7.60
13 T	....	1	6	14	31	16	2	....	....	70	481	6.87
14.00 T	....	1	1	6	1	4	1	....	....	14	93	6.64
14.25 T	....	....	1	1	10	6	....	1	....	19	139	7.32
14.50 T	....	....	1	3	1	5	1	1	....	12	89	7.42
14.75 T	....	....	....	1	1	1	1	....	....	4	30	7.50
14 S	....	1	3	11	7	11	3	2	....	38	269	7.08
14 P	....	....	....	....	1	2	....	....	....	3	23	7.67
14 U	....	....	....	....	5	3	....	....	....	8	59	7.37
14 T	....	1	3	11	13	16	3	2	....	49	351	7.16
15.00 T	....	....	2	4	3	1	2	1	....	13	91	7.00

TABLE 2.—*Memory span of 751 boys, 6 to 17.75 years old, inclusive, of the city of X, summarized by quarter-year periods, total-year periods, and sanitary groups*—Contd.

Age.	Number in memory span, with number of children attaining each span.									Number of pupils.	Memory span.	
	3	4	5	6	7	8	9	10	11		Total.	Average.
15.25 T	....	....	1	....	7	5	5	....	....	18	139	7.72
15.50 T	....	....	....	1	6	1	....	....	....	8	56	7.00
15.75 T	....	....	1	4	6	4	....	....	....	15	103	6.87
15 S	....	....	4	5	18	9	4	1	....	41	294	7.17
15 P	....	....	....	1	1	1	1	....	....	4	30	7.50
15 U	....	....	....	3	3	1	2	....	....	9	65	7.22
15 T	....	....	4	9	22	11	7	1	....	54	389	7.20
16.00 T	....	....	4	2	1	1	....	....	....	8	55	6.87
16.25 T	....	....	....	....	3	4	1	....	....	8	62	7.75
16.50 T	....	....	....	3	7	5	....	2	....	17	127	7.47
16.75 T	....	....	....	....	2	....	1	....	....	3	23	7.67
16 S	....	....	....	7	11	9	3	1	....	31	228	7.35
16 P	....	....	....	....	1	1	....	1	....	3	25	8.33
16 U	....	....	....	....	2	....	....	....	....	2	14	7.00
16 T	....	....	....	7	14	10	3	2	....	36	267	7.42
17.00 T	....	....	....	2	1	1	....	....	....	4	27	6.75
17.25 T	....	....	....	....	1	1	2	....	....	4	33	8.25
17.50 T	....	....	....	1	2	1	....	1	....	5	38	7.60
17.75 T	....	....	....	1	1	....	1	....	....	3	22	7.33
17 S	....	....	....	2	4	3	2	1	....	12	92	7.67
17 P	....	....	....	1	1	....	....	....	....	2	13	6.50
17 U	....	....	....	1	....	....	1	....	....	2	15	7.50
17 T	....	....	....	4	5	3	3	1	....	16	120	7.50

TABLE 3.—*Memory span of 834 girls, 6 to 17.75 years old, inclusive, of the city of X, summarized by quarter-year periods, total-year periods, and sanitary groups.*

[*P*=children from homes provided with a privy; S=children from homes with sewer connection but without a privy; U=home sanitation unknown; T=total of P, S, and U.]

Age.	Number in memory span, with number of children attaining each span.									Number of pupils.	Memory span.	
	3	4	5	6	7	8	9	10	11		Total.	Average.
6.00 T	....	....	....	1	1	....	....	....	....	2	13	6.50
6.25 T	....	1	7	1	1	....	....	....	....	10	52	5.20
6.50 T	....	1	4	6	....	1	....	....	....	12	68	5.67
6.75 T	....	1	3	2	1	....	....	....	....	7	38	5.43
6 S	....	2	13	9	2	1	....	....	....	27	149	5.52
6 P	....	....	1	1	1	....	....	....	....	3	18	6.00
6 U	....	1	....	....	....	....	....	....	....	1	4	4.00
6 T	....	3	14	10	3	1	....	....	....	31	171	5.52
7.00 T	....	4	6	5	....	....	....	....	....	15	76	5.07
7.25 T	....	1	5	6	2	4	....	....	....	18	111	6.17
7.50 T	....	1	6	6	2	....	....	....	....	15	84	5.60
7.75 T	....	3	6	2	2	....	....	....	....	13	68	5.23
7 S	....	6	14	12	4	3	....	....	....	39	218	5.59
7 P	....	2	5	7	1	1	....	....	....	16	90	5.62
7 U	....	1	4	....	1	....	....	....	....	6	31	5.17
7 T	....	9	23	19	6	4	....	....	....	61	339	5.56
8.00 T	1	4	2	6	3	2	....	....	....	18	102	5.67
8.25 T	....	....	3	4	2	2	....	....	....	11	69	6.27
8.50 T	....	....	4	9	3	1	....	....	....	17	103	6.06
8.75 T	....	2	3	6	4	4	....	....	....	19	119	6.26
8 S	1	2	9	15	10	9	....	....	....	46	288	6.26
8 P	....	3	2	10	2	....	....	....	....	17	96	5.65
8 U	....	1	1	....	....	....	....	....	....	2	9	4.50
8 T	1	6	12	25	12	9	....	....	....	65	393	6.05
9.00 T	1	1	3	6	3	5	....	....	....	19	119	6.26
9.25 T	....	1	1	5	10	2	1	....	....	20	134	6.70
9.50 T	....	....	4	7	10	2	1	....	....	24	157	6.54
9.75 T	....	....	1	2	9	3	....	....	....	15	104	6.93
9 S	....	1	3	12	24	11	2	....	....	53	365	6.89
9 P	1	1	4	7	7	1	....	....	....	21	126	6.00
9 U	....	....	2	1	1	....	....	....	....	4	23	5.75
9 T	1	2	9	20	32	12	2	....	....	78	514	6.59
10.00 T	....	2	3	9	8	2	1	....	....	25	158	6.32

TABLE 3.—*Memory span of 834 girls, 6 to 17.75 years old, inclusive, of the city of X, summarized by quarter-year periods, total-year periods, and sanitary groups*—Continued.

Age.	Number in memory span, with number of children attaining each span.									Number of pupils.	Memory span.	
	3	4	5	6	7	8	9	10	11		Total.	Average.
10.25 T	....	1	2	8	6	2	1	....	....	20	129	6.45
10.50 T	....	1	7	6	7	2	....	1	....	24	150	6.25
10.75 T	....	....	2	10	7	2	1	....	....	22	144	6.55
10 S	....	4	13	22	22	6	1	1	....	69	434	6.29
10 P	....	....	1	10	6	2	2	....	....	21	141	6.71
10 U	....	....	....	1	....	....	....	....	....	1	6	6.00
10 T	....	4	14	33	28	8	3	1	....	91	581	6.38
11.00 T	....	1	2	9	10	4	....	....	....	26	170	6.54
11.25 T	....	....	....	3	6	2	1	....	....	12	85	7.08
11.50 T	....	....	1	7	14	8	1	....	....	31	218	7.03
11.75 T	....	....	1	4	2	1	1	....	1	10	71	7.10
11 S	....	1	4	17	20	15	2	....	1	60	415	6.92
11 P	....	....	....	5	11	....	1	....	....	17	116	6.82
11 U	....	....	....	1	1	....	....	....	....	2	13	6.50
11 T	....	1	4	23	32	15	3	....	1	79	544	6.89
12.00 T	....	....	....	3	8	2	1	....	....	14	99	7.07
12.25 T	....	1	2	8	2	4	....	1	....	18	118	6.56
12.50 T	....	1	4	5	9	8	1	....	....	28	190	6.79
12.75 T	....	....	....	7	3	4	1	2	....	17	124	7.29
12 S	....	2	5	17	18	14	....	3	....	59	403	6.83
12 P	....	....	1	5	3	3	3	....	....	15	107	7.13
12 U	....	....	....	1	1	1	....	....	....	3	21	7.00
12 T	....	2	6	23	22	18	3	3	....	77	531	6.90
13.00 T	....	....	....	....	4	8	2	....	....	14	96	6.86
13.25 T	....	....	1	1	10	6	3	....	....	21	156	7.43
13.50 T	....	....	4	6	8	8	3	2	....	31	223	7.19
13.75 T	....	....	3	5	8	9	1	1	....	27	192	7.11
13 S	....	....	6	13	28	19	6	3	....	75	540	7.20
13 P	....	....	2	3	5	4	1	....	....	15	104	6.93
13 U	....	....	....	....	1	2	....	....	....	3	23	7.67
13 T	....	....	8	16	34	25	7	3	....	93	667	7.17
14.00 T	....	1	1	10	7	5	1	....	....	26	177	6.81
14.25 T	....	....	....	3	7	6	3	....	....	19	142	7.47
14.50 T	....	1	1	12	5	8	3	1	....	31	217	7.00
14.75 T	....	....	1	3	3	6	1	....	....	14	101	7.21
14 S	....	1	2	19	18	20	5	1	....	66	469	7.11
14 P	....	1	1	7	4	3	2	1	....	19	131	6.89
14 U	....	....	....	2	....	2	1	....	....	5	37	7.40
14 T	....	2	3	28	22	25	8	2	....	90	637	7.08
15.00 T	....	....	....	4	11	7	1	....	....	22	159	7.23
15.25 T	....	....	....	1	10	6	....	....	....	17	124	7.29
15.50 T	....	....	2	2	8	4	3	....	....	19	137	7.21
15.75 T	....	1	2	2	5	1	1	1	....	13	88	6.77
15 S	....	1	2	6	26	16	4	1	....	56	406	7.25
15 P	....	....	2	2	7	2	1	....	....	14	96	6.86
15 U	....	....	....	1	....	....	....	....	....	1	6	6.00
15 T	....	1	4	9	33	18	5	1	....	71	508	7.15
16.00 T	....	....	1	3	7	4	1	....	....	16	113	7.06
16.25 T	....	....	1	4	9	7	....	....	....	21	148	7.05
16.50 T	....	....	....	3	8	7	1	....	....	19	139	7.32
16.75 T	....	....	....	2	4	6	....	....	....	12	88	7.33
16 S	....	....	2	7	25	22	2	....	....	58	421	7.26
16 P	....	....	....	2	3	1	....	....	....	6	41	6.83
16 U	....	....	....	3	....	1	....	....	....	4	26	6.50
16 T	....	....	2	12	28	24	2	....	....	68	488	7.18
17.00 T	....	....	....	2	3	1	4	1	....	11	87	7.91
17.25 T	....	....	....	1	2	4	1	....	....	8	61	7.62
17.50 T	....	....	....	....	1	1	1	1	....	4	34	8.50
17.75 T	....	....	1	2	1	2	1	....	....	7	49	7.00
17 S	....	....	1	5	7	7	7	2	....	29	223	7.69
17 P	....	....	....	....	....	1	....	....	....	1	8	8.00
17 U	....	....	....	....	....	....	....	....	....	....	....	....
17 T	....	....	1	5	7	8	7	2	....	30	231	7.70

Comparison by total-year periods and sex groups.—If the total-year periods be compared (see chart 1), it is seen that there is in general a gradual increase in the memory span from the younger to the older groups. This increase is not, however, regular from year to year, for in the boys the 10-year-old period excelled the 11-year-old period,

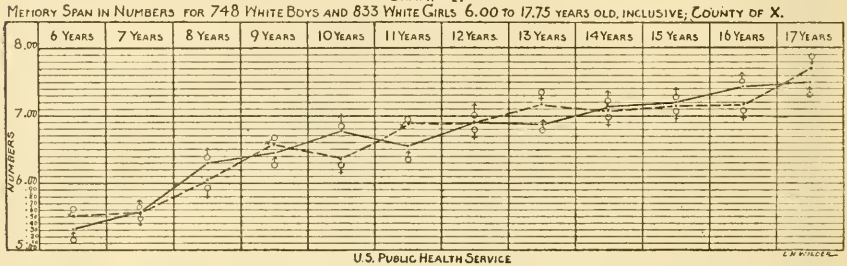
and the 12-year-old period excelled the 13-year-old period; among the girls the 9-year-old period excelled the 10-year-old period, and the 13-year-old period excelled the 14- and 15-year-old periods.

If the two sex groups (chart 1) for each year be compared, it is seen that neither sex uniformly excelled the other; in 5 total-year periods (6, 9, 11, 13, and 17 years) the girls excelled the boys; and in 6 total-year periods (7, 8, 10, 14, 15, and 16 years) the boys excelled the girls, but the difference in one instance is negligible; the boys and girls were equal, or practically equal, in 2 periods (7 and 12 years).

The conclusion would therefore seem to be justified that no essential difference was shown between the memory spans of the two sexes, and that while there was in general a gradual increase in the average memory span from younger to older children, this increase did not express itself in exact ratio to age. Considering the matter from a standpoint of the average of accomplishment per year in chronological age rather than the average per year in mental age, it would

CHART-1.

MEMORY SPAN IN NUMBERS FOR 748 WHITE BOYS AND 833 WHITE GIRLS 6.00 TO 17.75 YEARS OLD, INCLUSIVE; COUNTY OF X.



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appear reasonable to expect that the average white child, boy or girl, in the locality in question, and in the "stage setting" used, will show the following memory spans:

	Numbers.
Children 6 and 7 years old	5
Children 8 to 13 years (inclusive) old	6
Children 14 to 17 years (inclusive) old	7

Thus the average child of 6, 7, 8, and 9 years (chronological age) exceeded the memory span as given by Strong, and the average child of 12 and 13 years did not attain the memory span as given by Strong. Whether this indicates that Strong's conclusion as to the memory span at different ages should be revised or whether it indicates a precocity of the younger children and a retardation of the older children studied, or a difference of results due to different "stage settings" may be left *sub judice.*

Comparison of sanitary groups.—In a former article[1] it was shown that children from sewered homes advance, on an average, more rapidly in school grades than do the children from homes provided with privies.

[1] Public Health Reports, v. 30 (28), July 9, 1915, pp. 2060-2067.

If the sanitary groups in the memory-span tabulations are compared for the total years (in order to obtain larger groups than are furnished by the quarter-year divisions), it is seen that there are 48 sanitary groups (24 "S" groups, 24 "P" groups) that can be compared. In these 24 comparisons (12 of boys, 12 of girls), 14 S groups (7 of boys, 7 of girls) excel as compared with 10 P groups (5 of boys, 5 of girls) that excel; but the S groups are larger than the P groups.

So far as it is possible to judge, on basis of the 1,585 white children (751 boys, 834 girls) studied, the children from sewered homes average a higher memory span than do the corresponding children from privy homes. It is further worthy of notice that in at least 5 of the P groups that stand higher than the corresponding S groups the number of children in the P groups is so small (one-ninth or less) as compared with the corresponding S groups that the value of the comparison in these 5 groups is materially reduced. For instance—

Boys 14 P contains only 3 pupils as compared with 14 S (38 pupils).
Boys 15 P contains only 4 pupils as compared with 15 S (41 pupils).
Boys 16 P contains only 3 pupils as compared with 16 S (31 pupils).
Girls 6 P contains only 3 pupils as compared with 6 S (27 pupils).
Girls 17 P contains only 1 pupil as compared with 17 S (29 pupils).

The same statements made in a former article, in connection with the grade advancements, hold in connection with the memory spans, namely, that numerous sociological factors come into consideration in this connection and that the sanitation, with its attendant results, is only one of these factors. It is, however, clear that the children from the homes with b tter sanitation actually averaged a higher memory span than did the hildren from homes with poorer sanitation.

Cases of Intestinal Infections.

Hookworms.—Of the 83 white pupils (55 boys, 28 girls) who showed hookworm infection, memory-span results are available for 52 (36 boys, 16 girls). Computing these results on basis of the average for the separate sex, total-year, and sanitary groups, these 52 children were entitled to a total memory span of 343.24 (boys 237.20, girls 106.4); they actually made a total of 339 (boys 232, girls 107); thus they showed an average loss of 0.08 (boys 0.14 loss, girls 0.06 gain).

Ascaris.—Of the 58 pupils (46 boys, 12 girls) who showed *Ascaris* infection, memory-span results are available for 38 (29 boys, 9 girls). Computing these results on basis of the average for the separate sex, total-year, and sanitary groups, these 38 pupils were entitled to a total memory span of 245.23 (boys 187.60, girls 57.63); they actually made a total of 250 (boys 197, girls 53); thus they showed an average of 0.13 gain (boys 0.32 gain, girls 0.51 loss).

Lamblia.—Of the 99 pupils (71 boys, 28 girls) who showed *Lamblia* infection, memory-span results are available for 67 (50 boys, 17 girls).

Computing these results on basis of the average for the separate sex, total-year, and sanitary groups, these 67 pupils were entitled to a total memory span of 441.36 (boys 325.93, girls 115.43); they actually made a total of 444 (boys 331, girls 113); thus they showed an average of 0.04 gain (boys 0.10 gain, girls 0.14 loss).

Endamœba coli.—Of the 68 pupils (46 boys, 22 girls) who showed infection with *Endamœba coli*, memory-span results are available for 55 (39 boys, 16 girls). Computing these results on basis of the average for the separate sex, total-year, and sanitary groups, these 55 pupils were entitled to a total memory span of 367.29 (boys 259.31, girls 107.98); they actually made a total of 376 (boys 266, girls 110); thus they showed an average gain of 0.15 (boys 0.17, girls 0.13).

Other parasites.—The infections with *Trichuris*, *Trichomonas*, and *Hymenolepis* are too small in number to justify conclusions.

Conclusions.—The results obtained in pupils with parasitic infections (in general, light cases) do not show that the known infections with hookworms, eelworms, *Lamblia*, or *Endamœba coli* had any material influence in inhibiting the average memory span of their respective groups. It should, however, be recalled that only 31.7 per cent of the white pupils submitted specimens for microscopic examination, and we have no way of knowing whether or not intestinal infections were present in the two-thirds who were not examined for intestinal parasites.

Summary.

White urban school children in the sand district of the South may be reasonably expected to average the following memory spans: 6 and 7 years, chronological age, 5 numbers; 8 to 13 years, inclusive, 6 numbers; 14 to 17 years, inclusive, 7 numbers.

The children from homes with better sanitation can reasonably be expected to excel in memory span those from homes with poorer sanitation approximately in the ratio of 14 to 10, calculated on basis of total year periods.

The evidence at hand does not show that light infections with hookworms (*Necator*), eelworms (*Ascaris*), *Lamblia*, or *Endamœba coli* had any material effect in inhibiting the memory span of the children who were found to harbor these parasites, when their memory span was compared with the average of the children of their respective groups. This conclusion can not be extended at present to cases of severer infection with these parasites.

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